SAMSUNG MOBILE DISPLAY

Approval

TO :

DATE : Mar. 09. 10

SAMSUNG TFT-LCD

MODEL NO. : LMS350GF21

Customer Approval

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Any Modification of Spec is not allowed without SMD's permission.

Approved by : *J.O. Kwag*

Samsung Mobile Display

Approval

Revision History

Date	Rev No.	Page	Summary
Mar.09.2010	000		Rev.000 was issued.

Approval

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General Description

* Description

LMS350GF21 is a TMR(Transmissive with Micro Reflective) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit and a touch screen panel(TSP).

The resolution of a 3.5" contains 320xRGBx240 dots and can display up to 16.7M colors.

* Features

- Transmissive with Micro Reflective type and back-light with six LEDs are available.
- Using the Touch Screen Panel(Film-Glass type).
- TN(Twisted Nematic) mode.
- Line inversion mode with stripe type.
- 24bit RGB Interface + Serial Peripheral Interface(SPI)
- SYNC(Vsync, Hsync, Dotclk) mode,
  SYNC with DE(Enable, Vsync, Hsync, Dotclk) mode
- Gate Driver IC embeded on Panel(Double ASG)

* Applications

- Display terminals for PND, PMP, Photo Printer products.

* General information

Items	Specification	Unit	Note
Display area	70.08(H) x 52.56(V)	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	16.7M	colors	-
Number of pixels	320xRGB(H) x 240(V)	dot	-
Pixel arrangement	stripe type	-	-
Pixel pitch	0.219(H) x 0.219(V)	mm	-
Display mode	Normally White	-	-
Viewing direction	6	o'clock	-

* Mechanical information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	76.70	76.90	77.10	mm	-
	Vertical(V)	63.70	63.90	64.10	mm	(1)
	Depth(D)	4.05	4.25	4.45	mm	(1)
Weight		-	42	46	g	-

Note (1) Not include FPC.
Refer to the Outline Dimension in the "10.Outline Dimension" for further information.
(2) Touch Screen Panel and Back-light unit are included.

1. Absolute Maximum Ratings

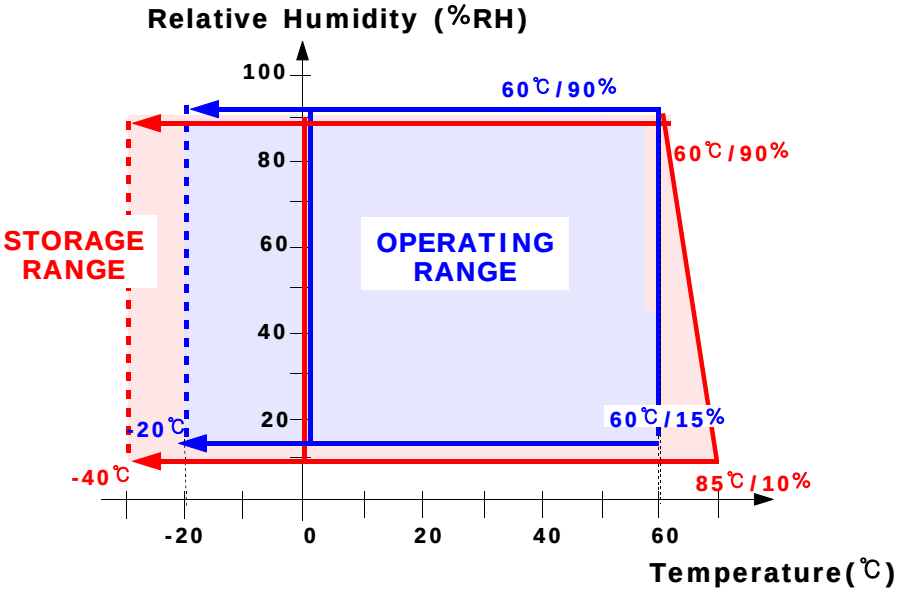
1.1 Environment

ITEM	MIN	MAX	REMARK
Storage Temperature	-40℃	85℃	Note(1)
Operating Temperature	-20℃	60℃	Note(2)(3)

Note(1) 90%RH maximum humidity, 60℃ maximum wet-bulb temperature

(2) When operated at a temperature lower than 0℃, the LCD worked slowly and the screen appeared low-contrast images due to the characteristics of LC(Liquid Crystal).

(3) If any fixed pattern is displayed on LCD for minutes, image-sticking phenomenon may occur.



<Temperature & Humidity Graph at Absolute Environment>

1.2 Electrical Absolute Ratings

(1) TFT-LCD Module

(Ta = 25 ± 2°C, V_{SS}=GND=0)

Characteristics	Symbol	Min.	Max.	Unit	Note
Analog supply voltage	VCI	-0.3	5.0	V	-
Digital supply voltage	VDD	-0.3	5.0	V	-

(2) Back-Light Unit

(Ta = 25 ± 2°C)

Item	Symbol	Min.	Max.	Unit.	Note
Current	I_B		25	mA	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.

2. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).
Measuring equipment: BM-7, SR-3, EZ-Contrast

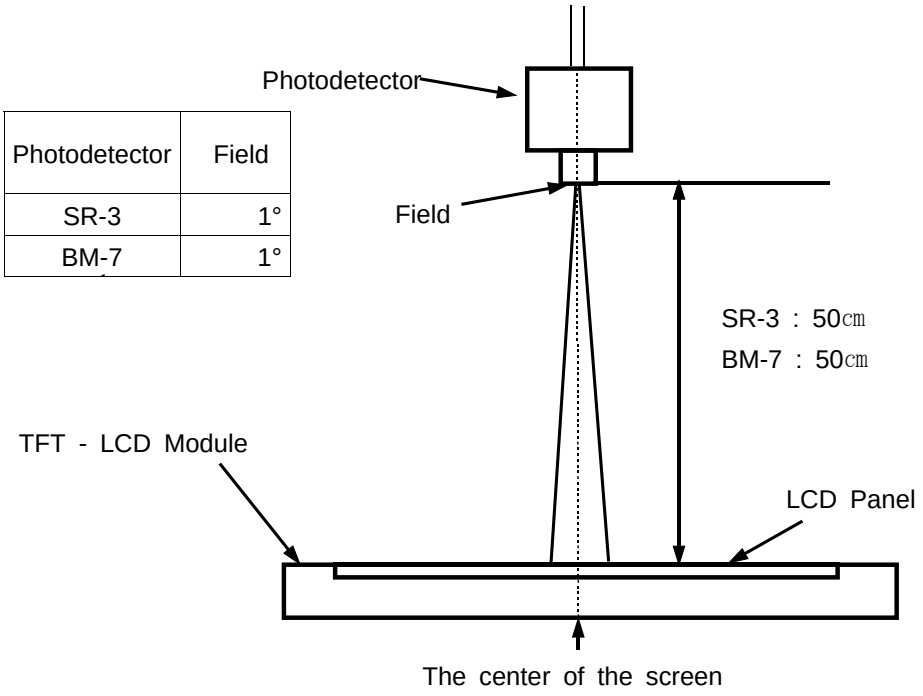
(Ta = 25 ± 2°C, VCI = 3.3V, VDD = 3.3V, I_B = 20mA)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast ratio (Center point)		C/R	NOTE (1) f = 0 q = 0 Normal Viewing Angle B/L On	150	300	-	-	(2) SR-3
Luminance of white (Center point)		YL		240	320	-	cd/㎡	(3) SR-3
Response time	Rising:Tr	Tr+Tf		-	25	-	msec	(4) BM-7
	Falling:Tf							
Color chromaticity (CIE 1931)	White	Wx		0.27	0.32	0.37	-	(5) SR-3
		Wy		0.29	0.34	0.39		
	Red	Rx		0.55	0.60	0.65		
		Ry		0.32	0.37	0.42		
	Green	Gx		0.30	0.35	0.40		
		Gy		0.52	0.57	0.62		
	Blue	Bx		0.10	0.15	0.20		
		By		0.06	0.11	0.16		
Viewing angle	Hor.	L	C/R³10 B/L On	55	65		Degrees	(6) Ez-Contrast
		qR		55	65			
	Ver.	fH		40	50			
		fL		45	55			

Note (1) Test Equipment Setup

After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the back-light. This should be measured in the center of screen.
Environment condition : Ta = 25 ± 2 °C
Back-Light On condition

Photodetector	Field
SR-3	1°
BM-7	1°



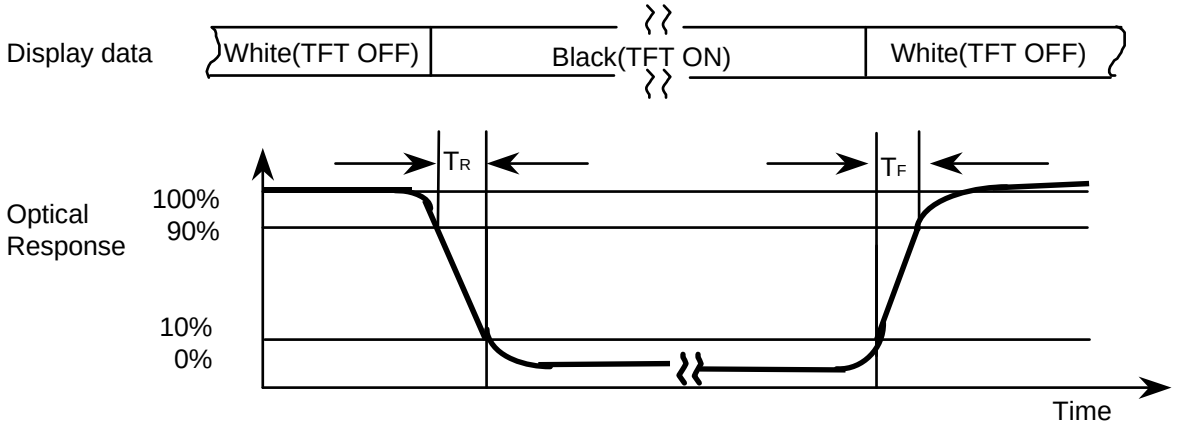
Note (2) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point

$$CR = \frac{G\max}{G\min}$$

* Gmax : Luminance with all pixels white
* Gmin : Luminance with all pixels black

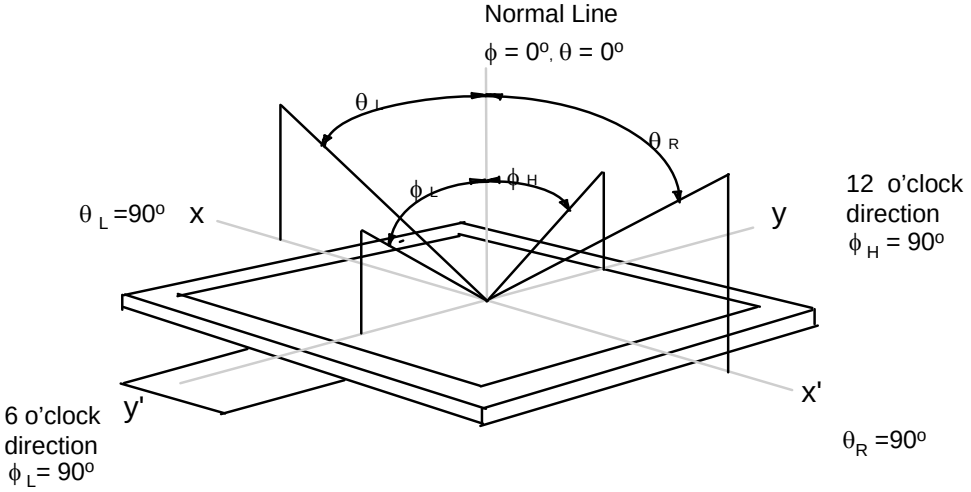
Note (3) Definition of Luminance of White : Luminance of white at the center point

Note (4) Definition of Response time : Sum of Tr ,Tf



Note (5) Definition of Color Chromaticity (CIE 1931)
Color coordinate of white & red, green, blue at center point.

Note (6) Definition of Viewing Angle : Viewing angle range (CR≥10)



3. Electrical Characteristics

3.1 TFT-LCD Module

(Ta = 25 ± 2°C)

Characteristics		Symbol	Min.	Typ.	Max.	Unit	Note
Power supply voltage		VCI	3.0	3.3	3.5	V	-
IO Power supply voltage		VDD	1.8	3.3	3.5	V	-
Power Dissipation	Black	P_{FULL}	-	60	70	mW	(1),(2)
	White	P	-	49	55		
Current Dissipation	Black	I_{FULL}	-	18.2	21.2	mA	
	White	I	-	14.6	16.7		
Frame frequency		f_{Frame}	70	75	80	Hz	-
Dot Clock		DCK	-	6.8	8	MHz	-
Serial Clock(write)		XSCK	-	-	10	MHz	

※ To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the Chapter 8. Power On/Off Sequence.

Note (1) VDD = 3.3V, VCI = 3.3V f_{Frame} = 75Hz, DOTCLK = 6.8MHz
(2) Dissipation current check pattern

▶ 0 Gray black pattern

3.2 Back-Light unit

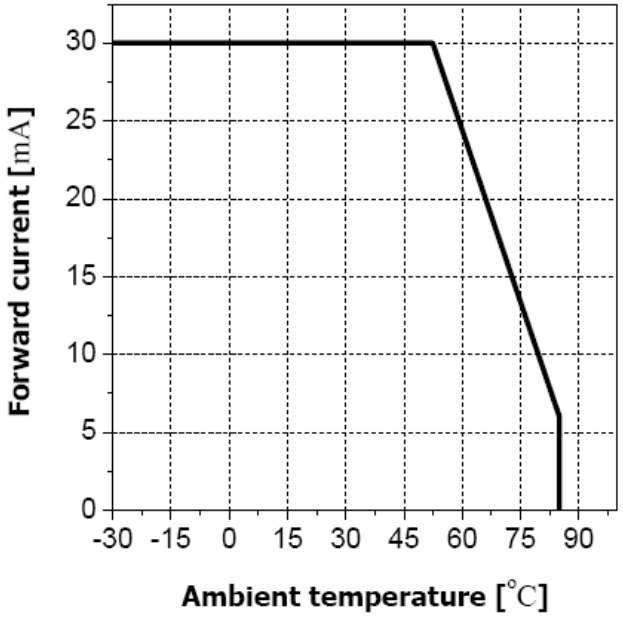
The back-light system is an edge-lighting type with six white LED(Light Emitting Diode)s.

(Ta=25 ± 2°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Current	I_B	-	20	-	mA	(1)
Power Consumption	P_{BL}	-	400	-	mW	(2)

Note (1) 6 LEDs serial type.
(2) Where I_B = 20mA, V_B = P_{BL} / I_B

Ambient Temp vs. Allowable Forward Current



4. Touch Screen Panel Specifications

4-1. Electrical Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal resistance	200	460	900	Ω	X(Film side)
	200	350	900	Ω	Y(Film side)
Insulation resistance	25	-	-	MΩ	DC 25V
Voltage	-	-	7	V	DC
Chattering	-	-	10	ms	100kΩ pull-up
Transparency	78	80	-	%	Non-glare

Caution (1) : Do not operate it with a thing except a polyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

4-2. Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit	Note
Activation force	5		80	g	(1)
Durability-surface scratching	Write 100,000	-	-	characters	(2)
Durability-surface pitting	1,000,000	-	-	touches	(3)
Surface hardness	3	-	-	H	JIS K5400, ASTM D3363

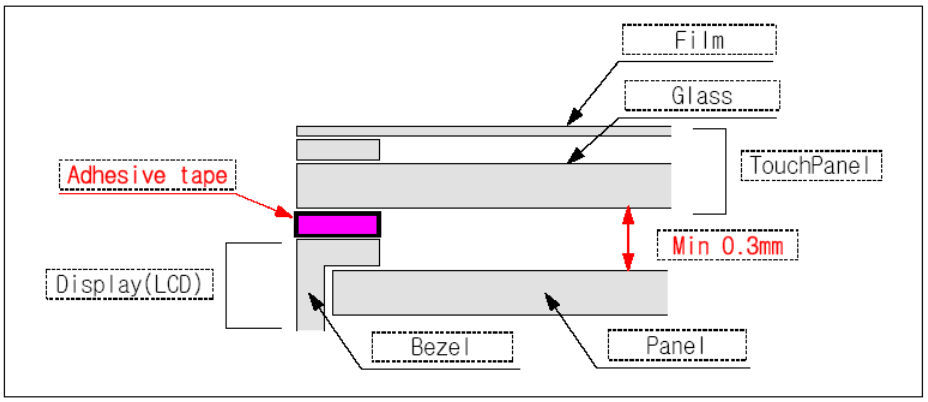
Note (1) Stylus pen Input : R0.8mm polyacetal pen or Finger

(2) Measurement for Surface area
- Scratch 100,000 times straight line on the Film with a stylus change every 20,000times
- Force : 250gf
- Speed : 60mm/sec
- Stylus : R0.8 polyacetal tip

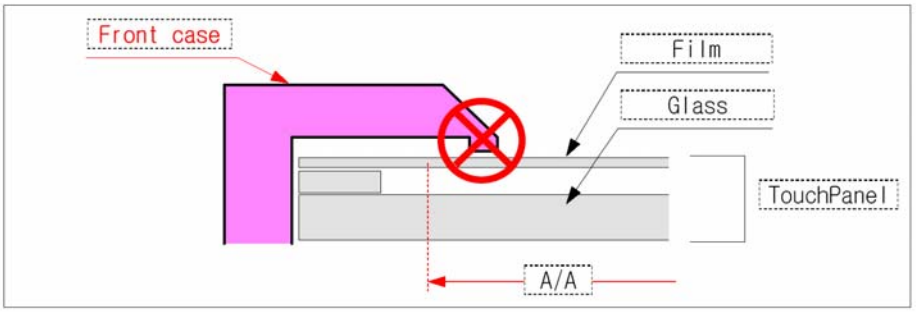
(3) Pit 1,000,000 times on the Film with a R8.0 silicon rubber.
- Force : 250gf
- Speed :2times/sec

4-3. Integration Design Guide

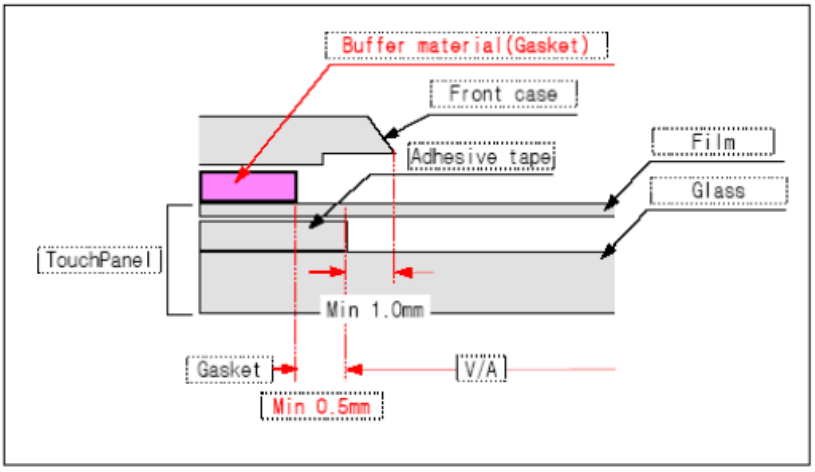
- Give enough clearance(over 0.3mm) between the touch-panel and a display to protect a display.



- Avoid the design that Front-case overlap and press on the active area of the touch-panel.
- Give enough gap (over 0.5mm at compressed) between the front case and touch-panel to protect wrong operating.



- Use a buffer material(Gasket) between the touch-panel and Front-case to protect damage and wrong operating.
- Avoid the design that buffer material overlap and press on the inside of touch-panel viewing area.



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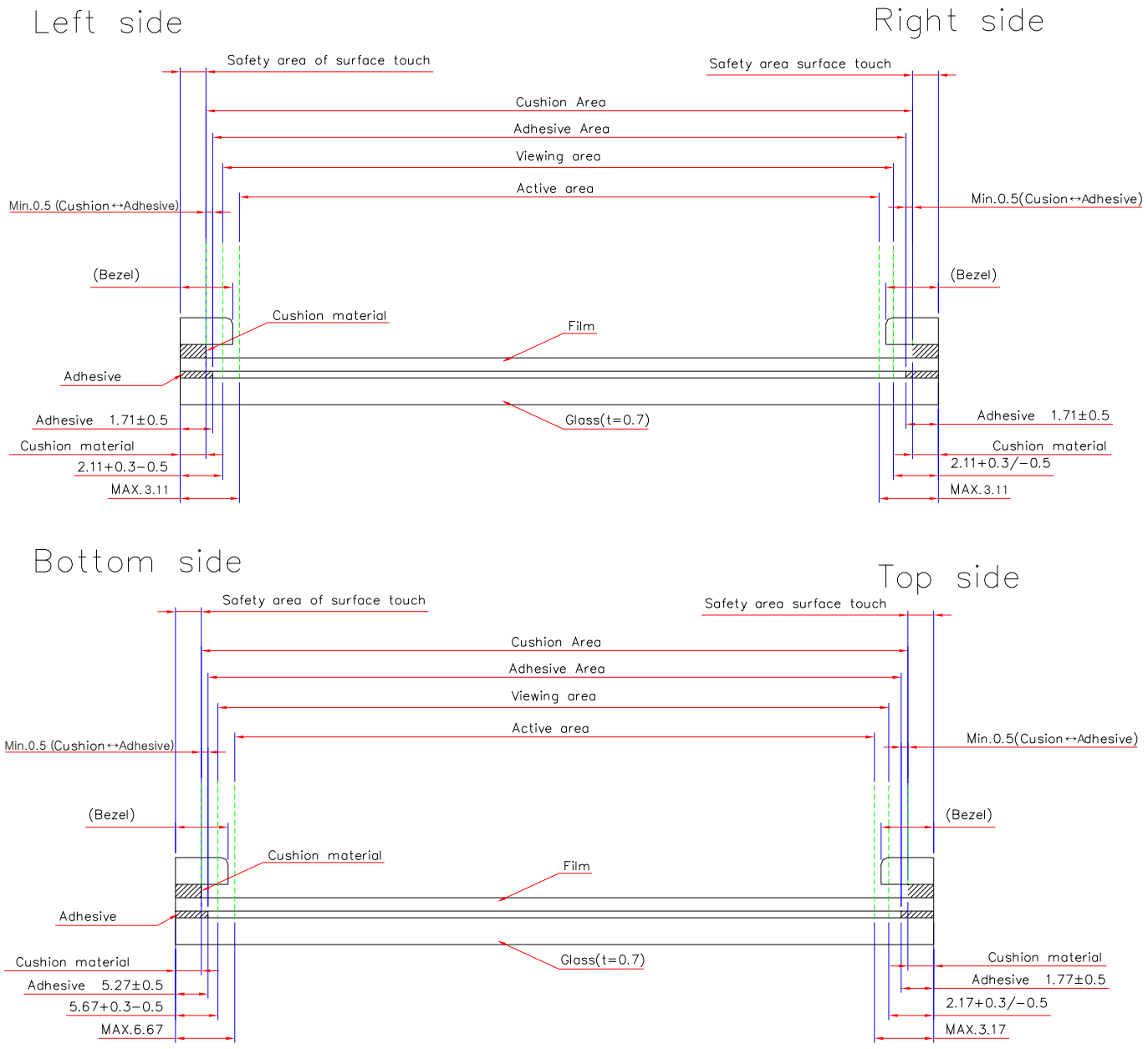
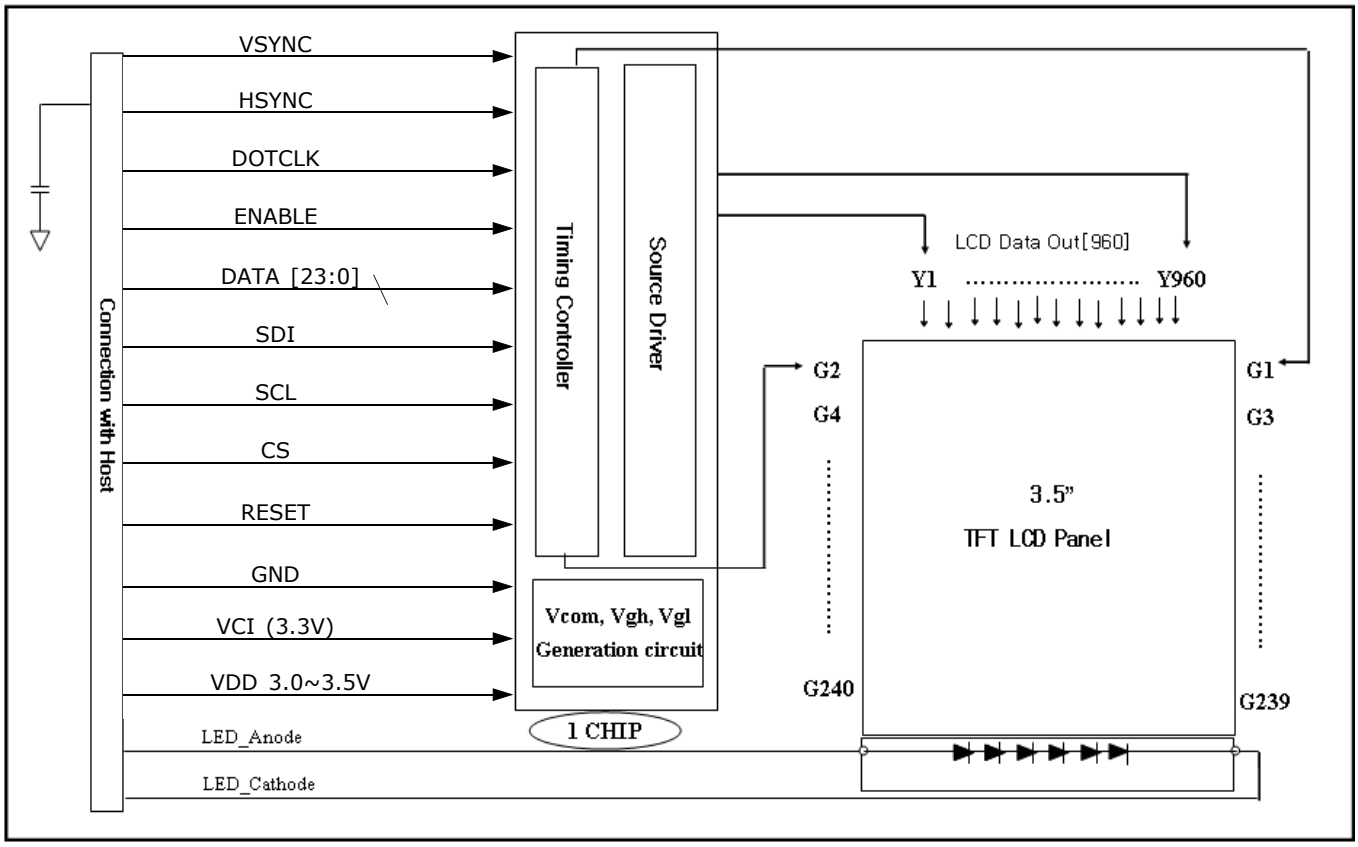
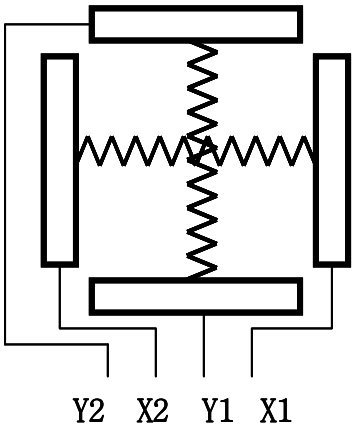

Left side
Safety area of surface touch
Cushion Area
Adhesive Area
Viewing area
Active area
Min.0.5 (Cushion↔Adhesive)
(Bezel)
Cushion material
Film
Adhesive
Adhesive 1.71±0.5
Glass(t=0.7)
Cushion material
2.11+0.3−0.5
MAX.3.11
Right side
Safety area surface touch
Min.0.5(Cusion↔Adhesive)
(Bezel)
Adhesive 1.71±0.5
Cushion material
2.11+0.3/−0.5
MAX.3.11
Bottom side
Safety area of surface touch
Cushion Area
Adhesive Area
Viewing area
Active area
Min.0.5 (Cushion↔Adhesive)
(Bezel)
Cushion material
Film
Adhesive
Glass(t=0.7)
Cushion material
Adhesive 5.27±0.5
5.67+0.3−0.5
MAX.6.67
Top side
Safety area surface touch
Min.0.5(Cusion↔Adhesive)
(Bezel)
Cushion material
Adhesive 1.77±0.5
2.17+0.3/−0.5
MAX.3.17

5. Block Diagram

5.1 TFT-LCD Module (Interface System Structure) with Back Light Unit



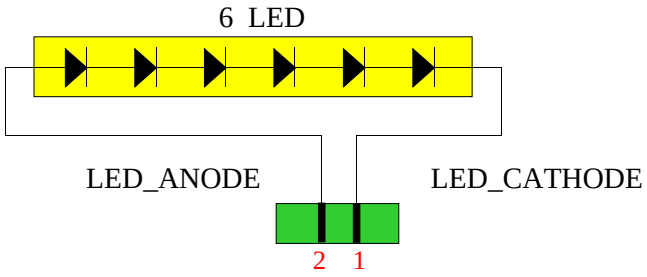
5.2 Touch Screen Panel



Top View

X : Lower electrode
Y : Upper electrode

5.3 Back-light Unit



Pin No.	Symbol	I/O
1	LED_CATHODE	Cathode
2	LED_ANODE	Anode

6. Input Terminal Pin Assignment

6.1 Input Signal & Power (Connector type : 71Pin / 0.3mm pitch / Bottom contact)

- HIROSE : FH26-71S-0.3SHW

No	Symbol	Description	I/O	No	Symbol	Description	I/O
1,2	LED-	LED__Cathode	I	26	VCI1	Stable Capacitor connection	O
3,4	LED+	LED__Anode	I	27,28	VCI	Main Power	I
5	GND	Ground	I	29	C23M	Stable Capacitor connection	O
6	X1	X_Right	I	30	C23P		
7	Y1	Y_Bottom	I	31	VCL	Stable Capacitor connection	O
8	X2	X_Left	I	32	VSSA	Ground	I
9	Y2	Y_Up	I	33	VCOMH	Stable Capacitor connection	O
10	GND	Ground	I	34	VCOML	Stable Capacitor connection	O
11	VGOFFL	Stable Capacitor connection	O	35	GVDD	Stable Capacitor connection	O
12	GND	Ground	I	36	RVDD	Stable Capacitor connection	O
13	VGL	Stable Capacitor connection	O	37	GND	Ground	I
14	GND	Ground	I	38,39	VDD	I/O Power	I
15	VGH	Stable Capacitor connection	O	40	VSYNC	Vertical Synchronous Signal	I
16	C22P	Stable Capacitor connection	O	41	HSYNC	Horizontal Synchronous Signal	I
17	C22M			42	DOTCLK	Data clock	I
18	C21P	Stable Capacitor connection	O	43	ENABLE	Data Enable (*NOTE)	I
19	C21M			44~51	DATA23~16	Red data(MSB ~ LSB)	I
20	AVDD	Stable Capacitor connection	O	52~59	DATA 15~8	Green data(MSB ~ LSB)	I
21	C11Pb	Stable Capacitor connection	O	60~67	DATA 7~0	Blue data(MSB ~ LSB)	I
22	C11Mb			68	SCL	Serial Clock	I
23	C11P	Stable Capacitor connection	O	69	CSB	Chip Select	I
24	C11M			70	SDI	Serial Data	I
25	VSSC	Ground	I	71	RESETB	Reset	I

* NOTE. Selects the RGB Interface mode.

(1) Connect Enable pin at GND in SYNC without Enable(DE) mode.

(2) Connect Enable pin at Enable in SYNC with Enable(DE) mode.

6.2 Back-Light Unit (Connector : 2 Pin FPC Solder type)

Pin No.	Symbol	Function
1	LED_CATHODE	LED Cathode
2	LED_ANODE	LED Anode

6.3 Touch Screen Panel (Connector : 4 Pin FPC Solder type)

Pin No.	Symbol	I/O	Function
1	X1	Right	Right electrode - differential analog
2	Y1	Bottom	Bottom electrode - differential analog
3	X2	Left	Left electrode - differential analog
4	Y2	Top	Top electrode - differential analog

6.4 Input Signal,Basic Display Colors and Gray Scale of Each Colors

COLOR	DISPLAY	DATA SIGNAL																								GRAY SCALE LEVEL
		RED								GREEN								BLUE								
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R252
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:			:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	G3~G252
	↓ LIGHT	:			:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	
		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B252
	↓ LIGHT	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B255

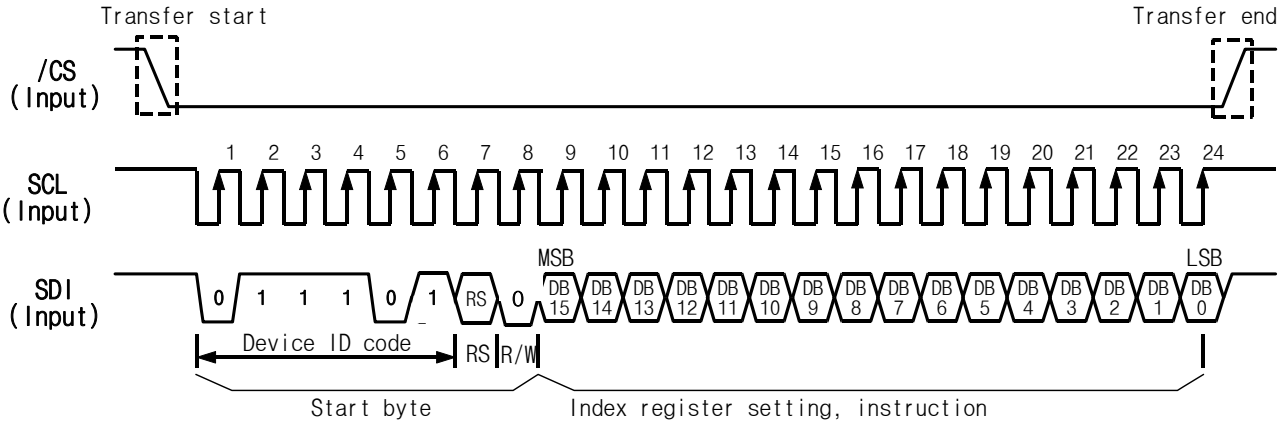
Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

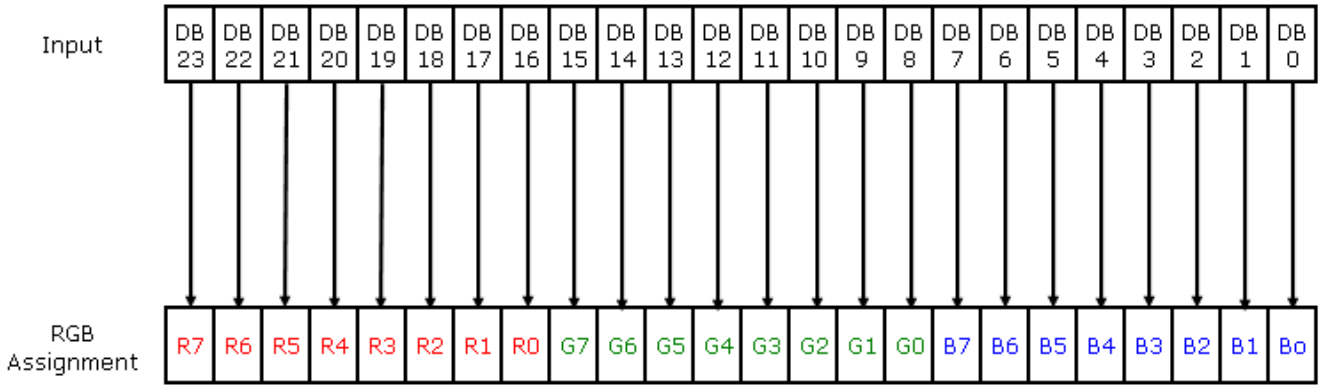
7. Operation Specifications

7.1 Serial Peripheral Interface


Transfer start
Transfer end
/CS
(Input)
SCL
(Input)
SDI
(Input)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
MSB
LSB
0 1 1 1 0 1 RS 0
DB 15 DB 14 DB 13 DB 12 DB 11 DB 10 DB 9 DB 8 DB 7 DB 6 DB 5 DB 4 DB 3 DB 2 DB 1 DB 0
Device ID code
RS R/W
Start byte
Index register setting, instruction

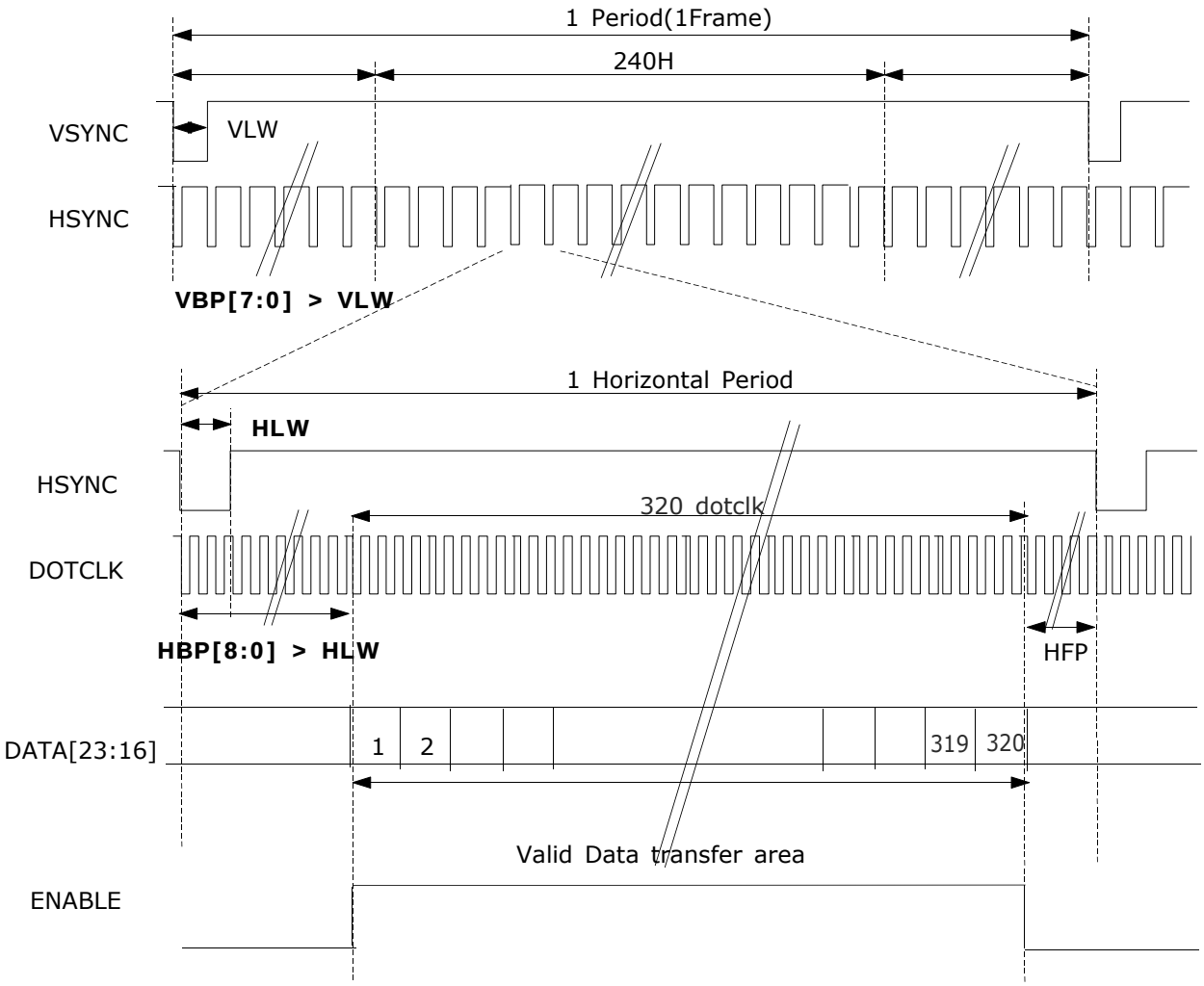
(Note) RS="0": Index data
RS="1": Instruction data

7.2 Data Format for 24bit RGB Interface


Input
DB 23 DB 22 DB 21 DB 20 DB 19 DB 18 DB 17 DB 16 DB 15 DB 14 DB 13 DB 12 DB 11 DB 10 DB 9 DB 8 DB 7 DB 6 DB 5 DB 4 DB 3 DB 2 DB 1 DB 0
RGB Assignment
R7 R6 R5 R4 R3 R2 R1 R0 G7 G6 G5 G4 G3 G2 G1 G0 B7 B6 B5 B4 B3 B2 B1 Bo

7.3 24bit RGB Interface Timing

- SYNC mode (Note 1)



* DOTCLK = f_{frame} × (240 + VBP + VFP) × (320 + HBP + HFP)
  = 75Hz × (240 + VBP + VFP) × (320 + HBP + HFP)
* VBP ≥ 3 , VBP > VLW ≥ 2
* HBP ≥ 8 , HBP > HLW ≥ 2

Note 1. Polarity register setting : VPL = 1, HPL = 1, DPL = 1, EPL =1 (page 27, 28)
2. The rising edge of DOTCLK is used to fetch display data

- Vertical Timing

※ Operating at VDD=2.9~3.5V , Ta = -40℃~+85℃

Signal	Symbol	min	Typ.	Max	Unit	Note
Frame Frequency	fFRM	70	75	80	Hz	
VSYNC(Frame) Period	VCYC	244	246	314	H	min: VDP+VBP+VFP(min)
VSYNC Low width	VLW	1	2	-	H	
Vertical Display Period	VDP	-	240	-	H	
Vertical Back porch	VBP	3	4	-	H	
Vertical Front porch	VFP	1	2	-	H	

- Horizontal Timing

※ Operating at VDD=2.9~3.5V , Ta = -40℃~+85℃

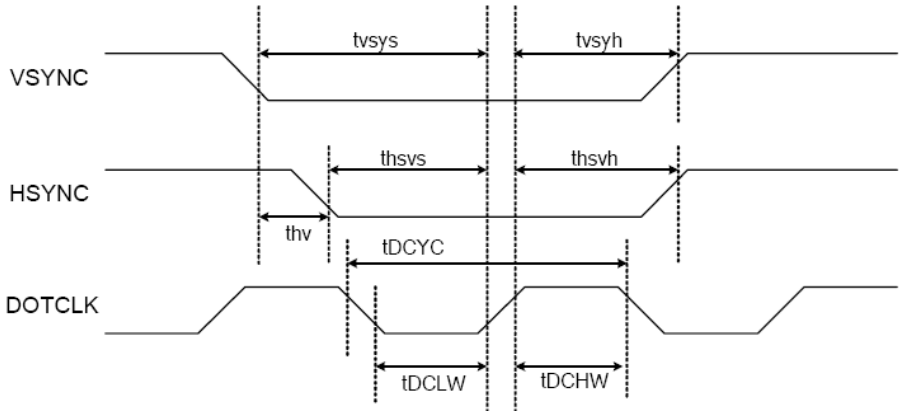
Signal	Symbol	min	Typ.	Max	Unit	Note
HSYNC(1H) Period	HCYC	332	360	434	DOTCLK	min: HDP+HBP+HFP(min)
HSYNC Low width	HLW	2	10	-	DOTCLK	
Horizontal Display Period	HDP	-	320	-	DOTCLK	
Horizontal Back porch	HBP	8	30	-	DOTCLK	
Horizontal Front porch	HFP	4	10	-	DOTCLK	
DOTCLK Frequence	f_{DOTCLK}	-	6.8 @fFRM=75Hz	8	MHz	VDD=2.9~3.5V

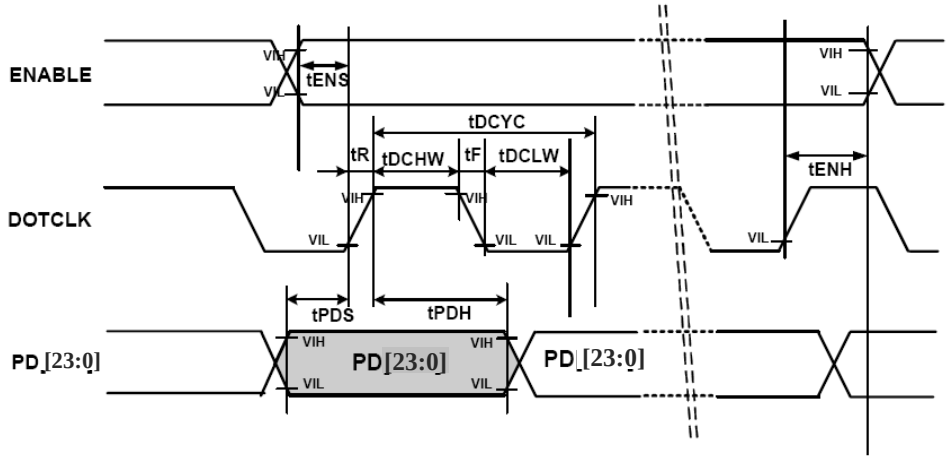
7.4 Electrical Specifications

a. RGB Data Interface Characteristics

VCI = 3.3V, TA = -40 to +85°C

Item	Symbol	Min.	Max.	Unit
Vsync/Hsync Setup Time	Tvsys/ Thsys	20	-	ns
Vsync/Hsync Hold Time	Tvsyh/ Thsyh	20	-	
Dotclk Low Level Pulse Width	tDCLW	50	-	
Dotclk High Level Pulse Width	tDCHW	50	-	
Dotclk Cycle Time	tDCYC	100	-	
Dotclk Rise/Fall Time	tR, tF	-	10	
Data Setup Time	tPDS	12	-	
Data Hold Time	tPDH	12	-	
ENABLE Setup time	tENS	40	-	
ENABLE Hold time	tENH	40	-	

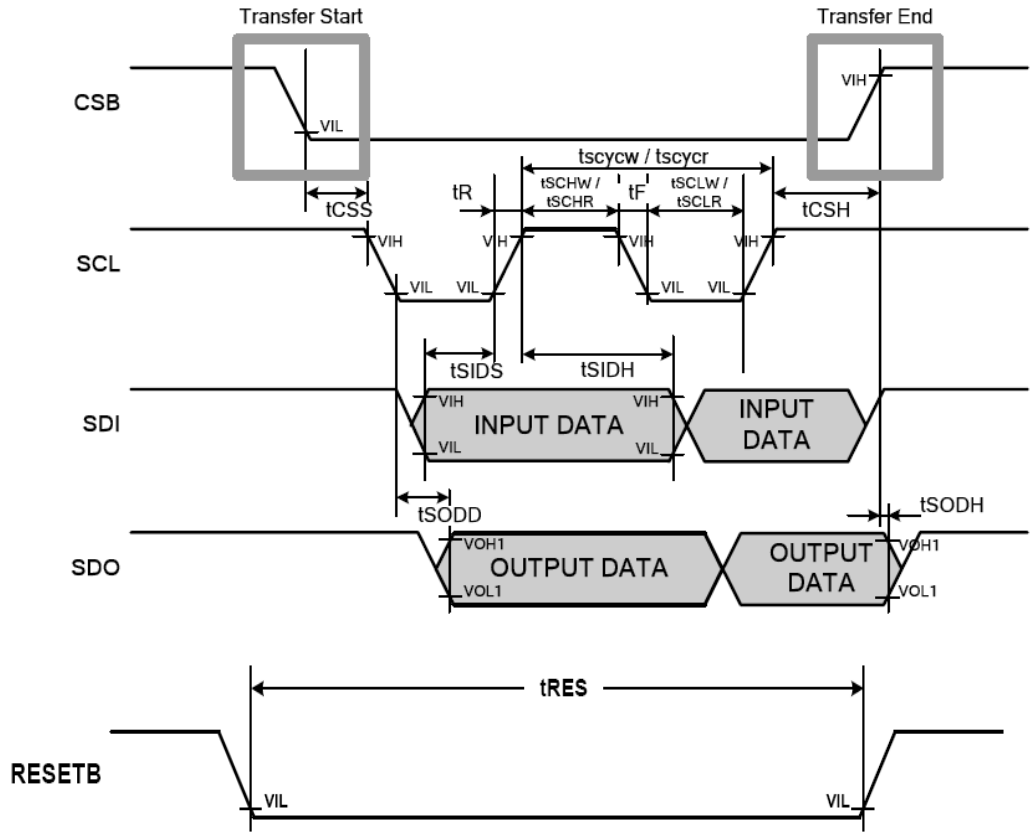




b. Clock Synchronized Serial Mode Characteristics

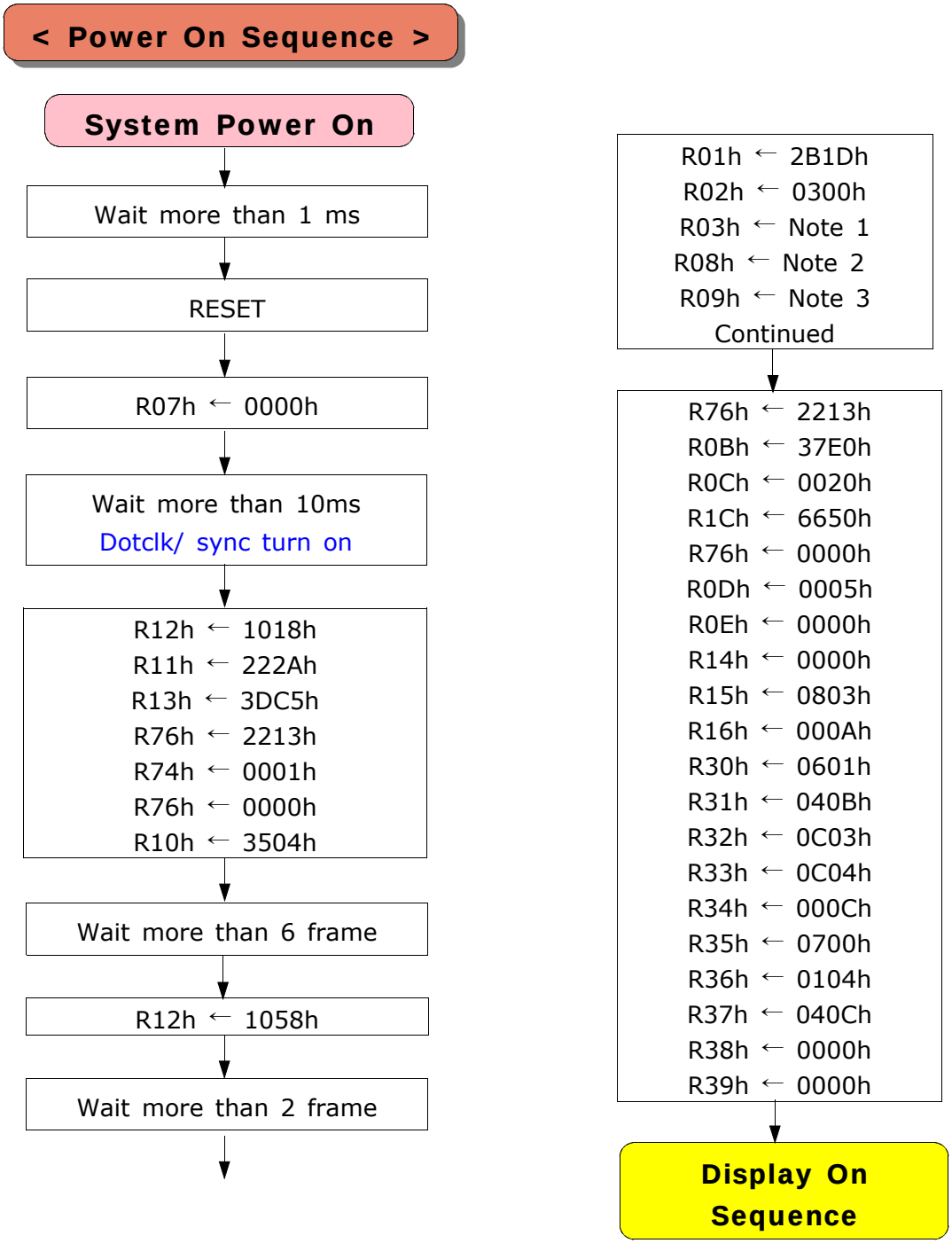
VCI = 3.3V, TA = -40 to +85°C

Item	Symbol	Min.	Max.	Unit
Serial Clock Cycle Time(write / read)	tSCYC	100/500	-	ns
Serial Clock rise/fall time	tR,tF	-	10	
Pulse width high for write	tSCHW	30	-	
Pulse width high for Read	tSCHR	240	-	
Pulse width low for write	tSCLW	50	-	
Pulse width high for Read	tSCLR	240	-	
Chip Select Setup Time	tCSS	20	-	
Chip Select Hold Time	tCSH	90	-	
Serial Input Data Setup Time	tSIDS	30	-	
Serial Input Data Hold Time	tSIDH	30	-	
Serial Output Data delay Time	tSODD	-	200(CL=50pF)	
Serial Output Data Hold Time	tSODH	5	-	
Reset Low Pulse Width	tRES	30	-	us



8. Power On/Off Sequence (Register Value can be changed)

8.1 Power On Sequence



Note 1) RGB INTERFACE MODE

DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
VPL	HPL	DPL	EPL	0	0	0	0	0	SYNC _MO	0	0	0	0	0	0

* VPL : Vsync Polarity (0 : High Active, 1 : Low Active)
* HPL : Hsync Polarity (0 : High Active, 1 : Low Active)
* DPL : Dotclk Polarity (0 : Data fetched at falling edge, 1 : at rising edge)
* EPL : EPL = 0 Enable = 'Low' (Writes data of PD23-0)
  Enable = 'High' (Does not write data of PD23-0)
  EPL = 1 Enable = 'Low' (Does not write data of PD23-0)
  Enable = 'High' (Writes data of PD23-0)

SYNC_MO	RGB Interface mode
0	SYNC with Enable(DE) Mode
1	SYNC without Enable(DE) Mode

Note 2) VBP (Vsync Back Porch)

DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	0	VBP7	VBP6	VBP5	VBP4	VBP3	VBP2	VBP1	VBP0

VBP 7	VBP 6	VBP 5	VBP 4	VBP 3	VBP 2	VBP 1	VBP 0	Number of Raster Periods In the Back Porch
0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	1	3
0	0	0	0	0	0	1	0	4
0	0	0	0	0	0	1	1	5
0	0	0	0	0	1	0	0	6
. . .								. . .
1	1	1	1	1	1	0	0	254
1	1	1	1	1	1	0	1	255
1	1	1	1	1	1	1	0	256
1	1	1	1	1	1	1	1	257

* The porch period should meet the following condition.
  VBP $\geq$ 3 , VBP > VLW $\geq$ 2

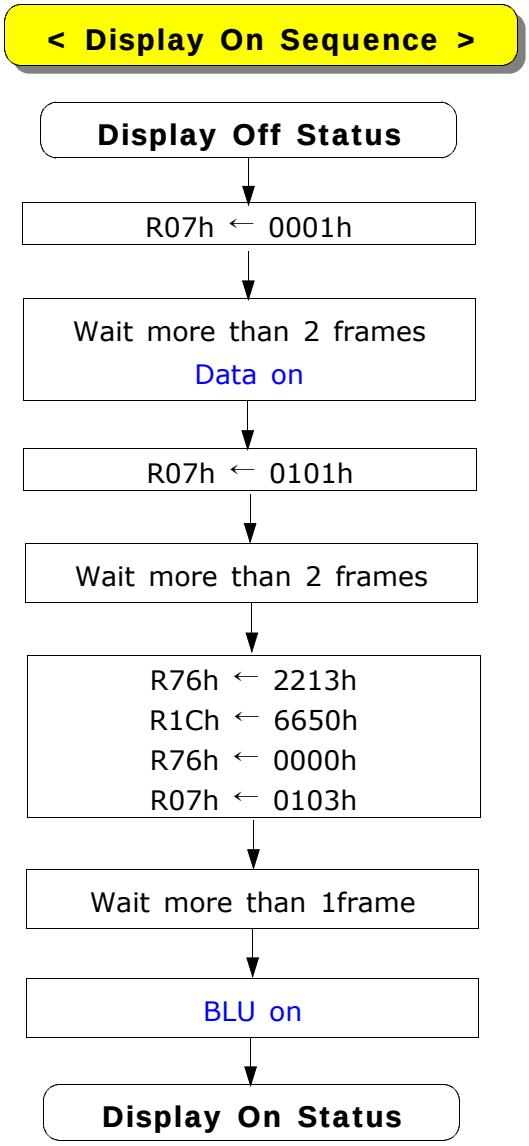
Note 3) HBP (Hsync Back Porch)

DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	0	0	0	HBP8	HBP7	HBP6	HBP5	HBP4	HBP3	HBP2	HBP1	HBP0

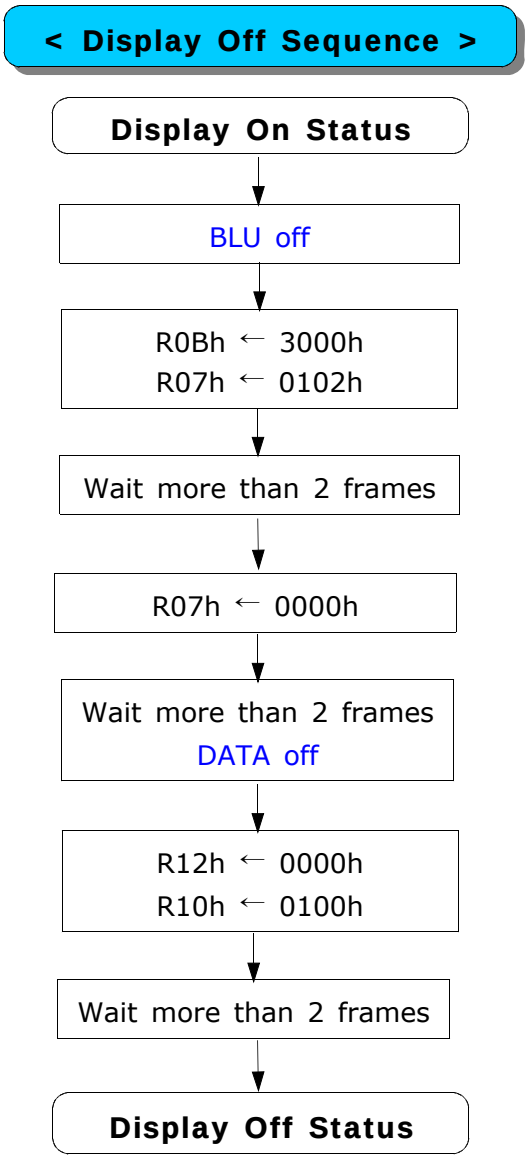
HBP 8	HBP 7	HBP 6	HBP 5	HBP 4	HBP 3	HBP 2	HBP 1	HBP 0	Number of MCLKs In the Back Porch 24 bit (8 bit)
0	0	0	0	0	0	0	0	0	8 (24)
0	0	0	0	0	0	0	0	1	8 (24)
0	0	0	0	0	0	0	1	0	8 (24)
0	0	0	0	0	0	0	1	1	8 (24)
0	0	0	0	0	0	1	0	0	8 (24)
0	0	0	0	0	0	1	0	1	8 (24)
0	0	0	0	0	0	1	1	0	8 (24)
0	0	0	0	0	0	1	1	1	8 (24)
0	0	0	0	0	1	0	0	0	8 (24)
0	0	0	0	0	1	0	0	1	9 (27)
0	0	0	0	0	1	0	1	0	10 (30)
0	0	0	0	0	1	0	1	1	11 (33)
				. . .					
1	1	1	1	1	1	1	0	1	509 (1527)
1	1	1	1	1	1	1	1	0	510 (1530)
1	1	1	1	1	1	1	1	1	511 (1533)

* The porch period should meet the following condition.
  HBP $\geq$ 8 , HBP > HLW $\geq$ 2

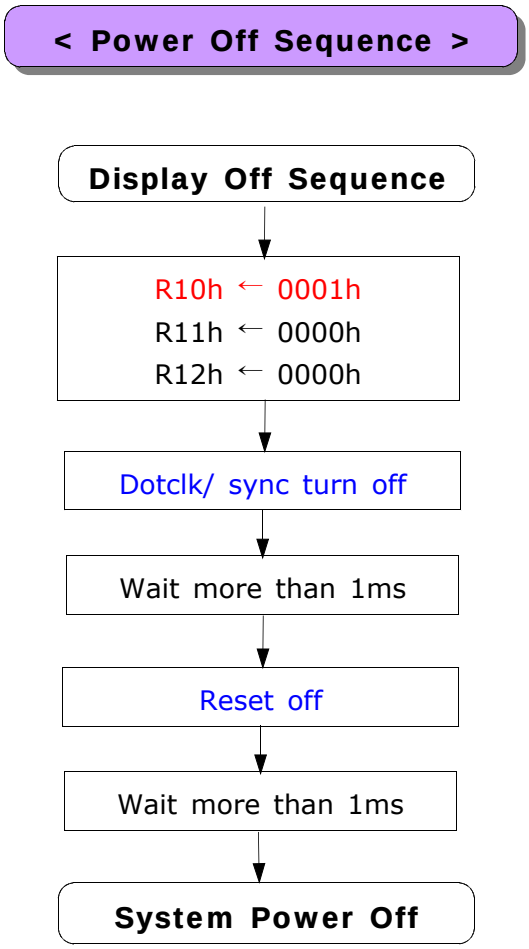
8.2 Display On Sequence



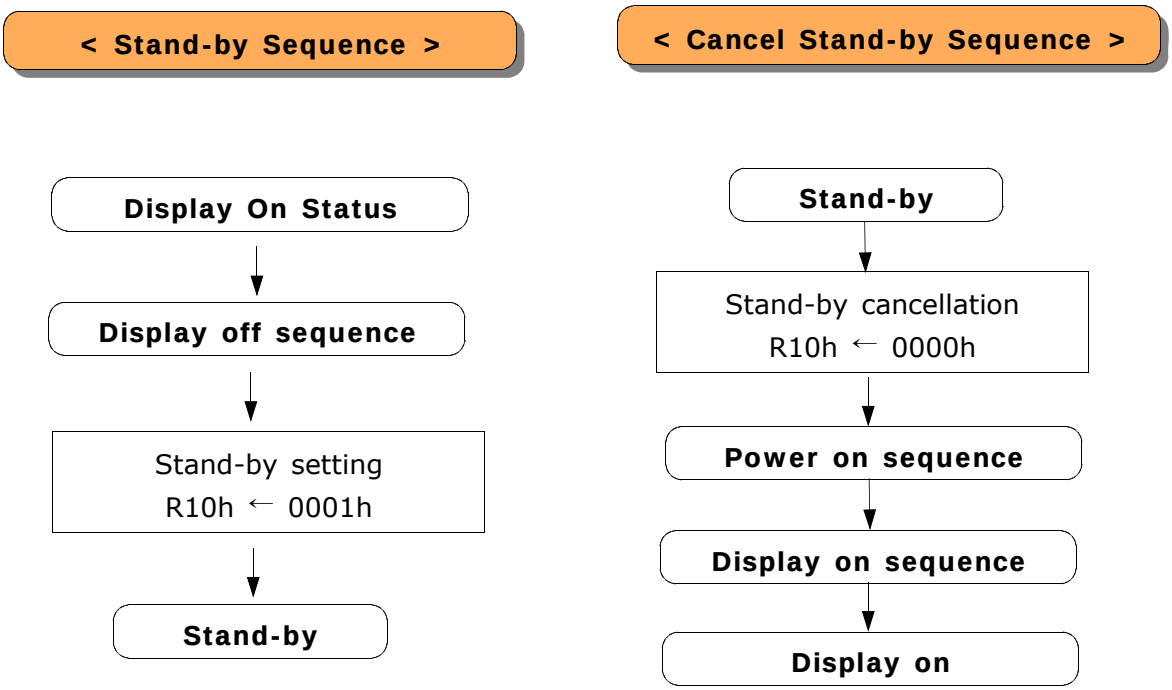
8.3 Display Off Sequence



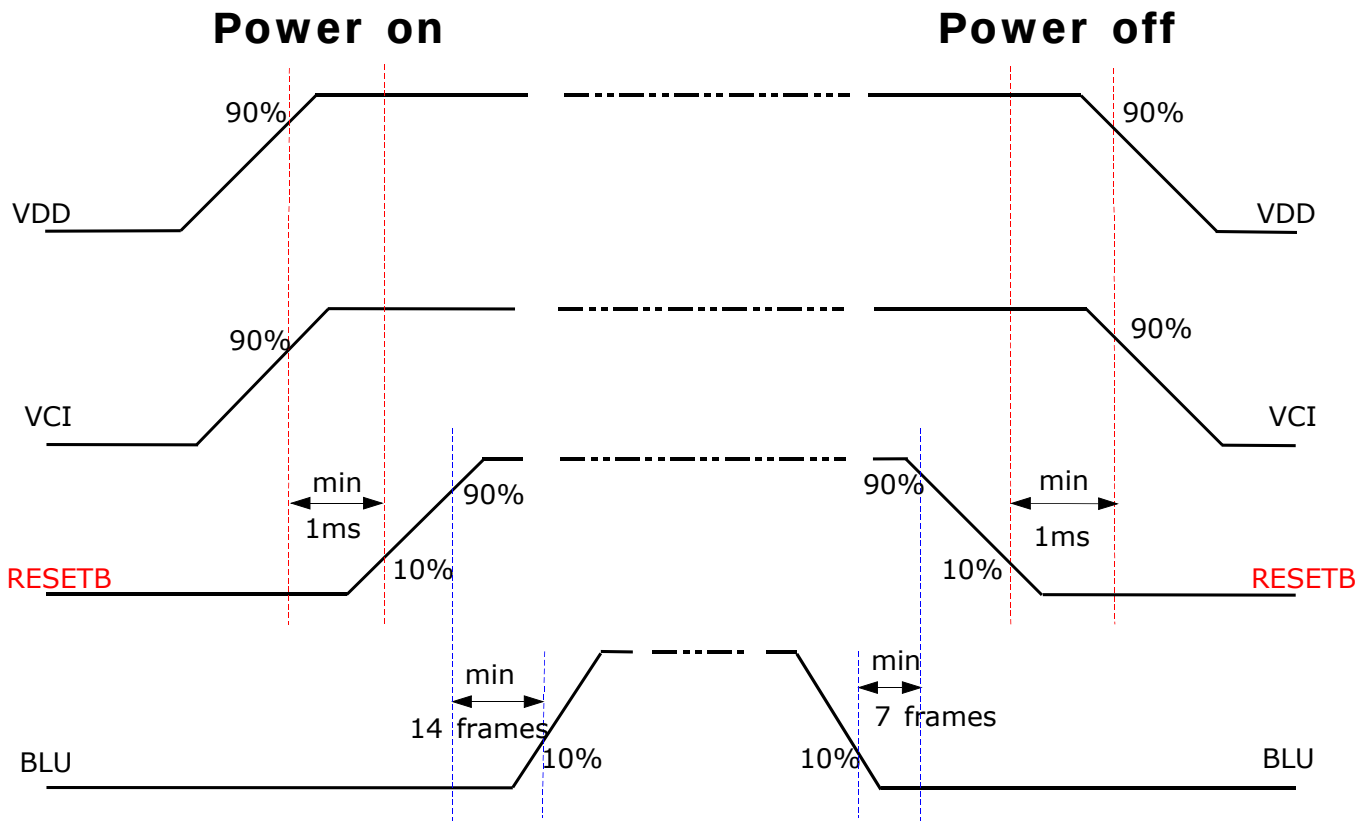
8.4 Power Off Sequence



8.5 Stand-by Sequence



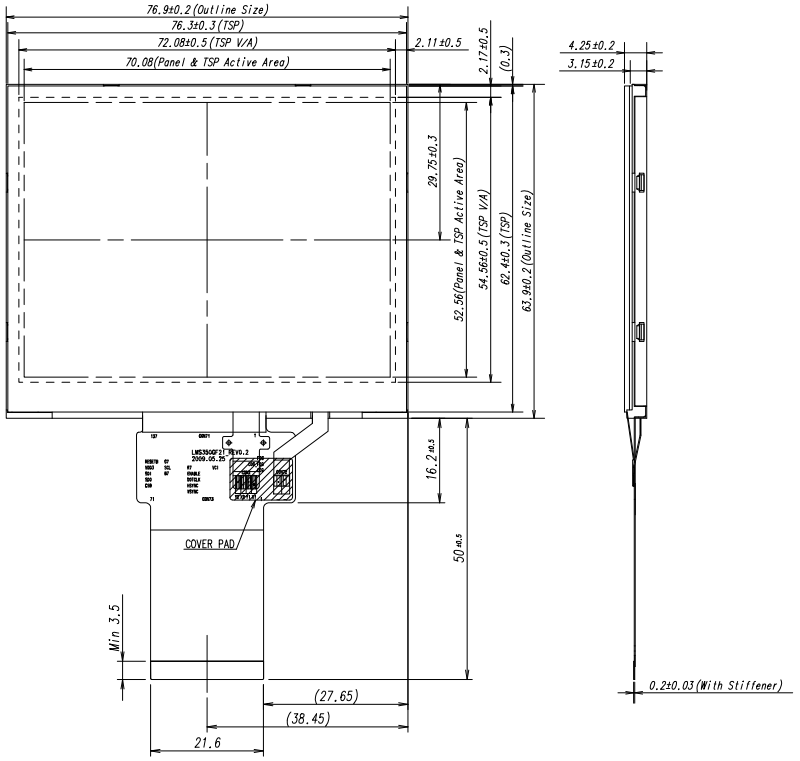
9. RESETB

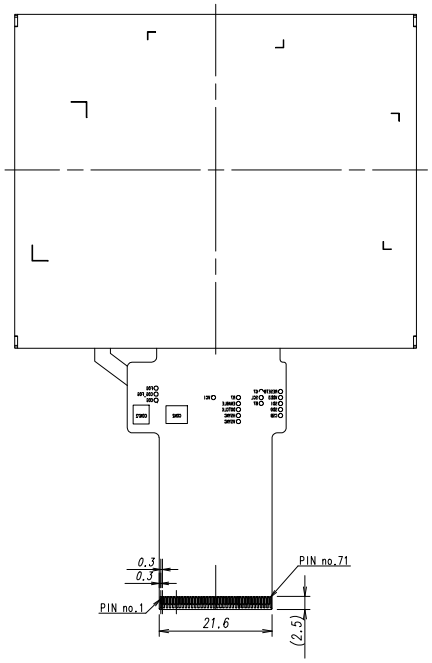


Note : VCI have to get more than 90% level of VCI
before control signals are applied

NO	PIN NAME		
1	LED-	44	DATA23
2	LED-	45	DATA22
3	LED+	46	DATA21
4	LED+	47	DATA20
5	GND	48	DATA19
6	X1	49	DATA18
7	Y1	50	DATA17
8	X2	51	DATA16
9	Y2	52	DATA15
10	GND	53	DATA14
11	VGOFFL	54	DATA13
12	GND	55	DATA12
13	VGL	56	DATA11
14	GND	57	DATA10
15	VGH	58	DATA9
16	C22P	59	DATA8
17	C22M	60	DATA7
18	C22P	61	DATA6
19	C22M	62	DATA5
20	AVDD	63	DATA4
21	C11Pb	64	DATA3
22	C11Pb	65	DATA2
23	C11P	66	DATA1
24	C11M	67	DATA0
25	VSSC	68	SCL
26	VCI1	69	CSB
27	VCI	70	SDI
28	VCI	71	RESETB
29	C23M		
30	C23P		
31	VCL		
32	VSSA		
33	VCOMH		
34	VCOML		
35	GVDD		
36	RVDD		
37	GND		
38	VDD		
39	VDD		
40	VSYNC		
41	HSYNC		
42	DOTCLK		
43	ENABLE		

NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	SPEC NO	REMARK





GENERAL TOLERANCE			
STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
4 < X ≤ 16	±0.08	±0.15	±0.3
16 < X ≤ 64	±0.12	±0.25	±0.5
64 < X ≤ 256	±0.25	±0.4	±0.8

REV	DATE	DESCRIPTION OF REVISION	REASON	CHG'D BY

UNIT	mm	DRA'N BY DES'D BY	CHK'D BY	APP'D BY
SCALE	1/1	S.I.CHANG	T.J.KIM	Y.B.CHU
TOLERANCE				
LEVEL 3		10.01.13	09.03.18	09.03.18

SAMSUNG MOBILE DISPLAY

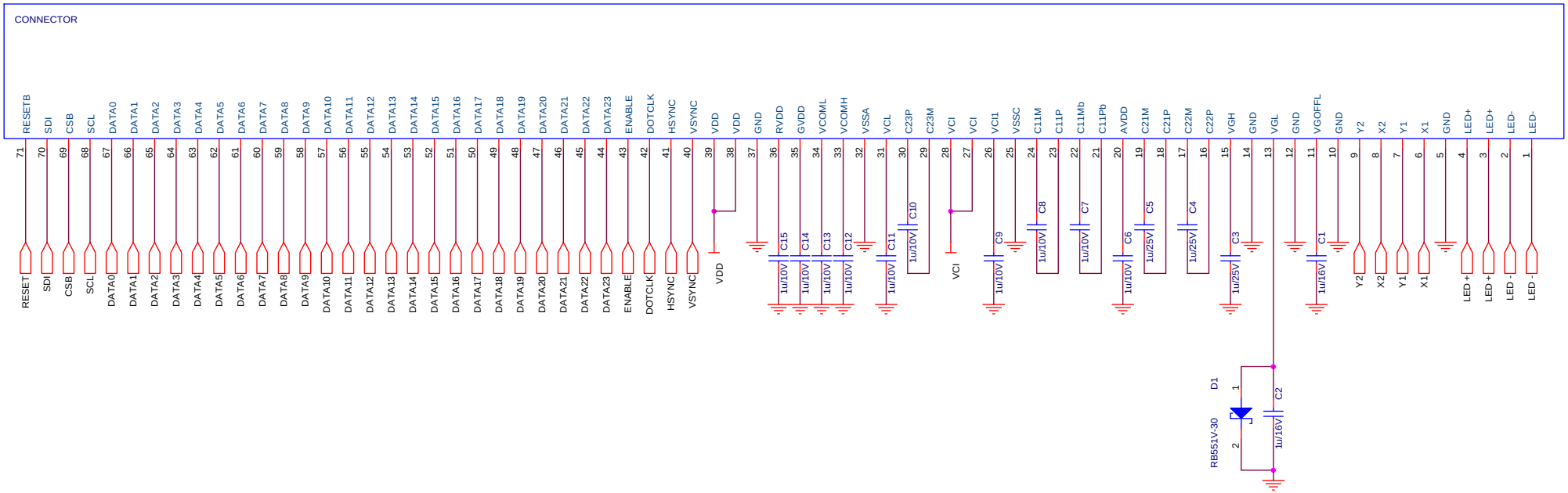
SPEC. NO

MODEL NAME	LMS350GF21		
PART/SHEET NAME	Outline dimension	SHEET	1/1
CODE NO.		VER.	000

11. Application Circuit

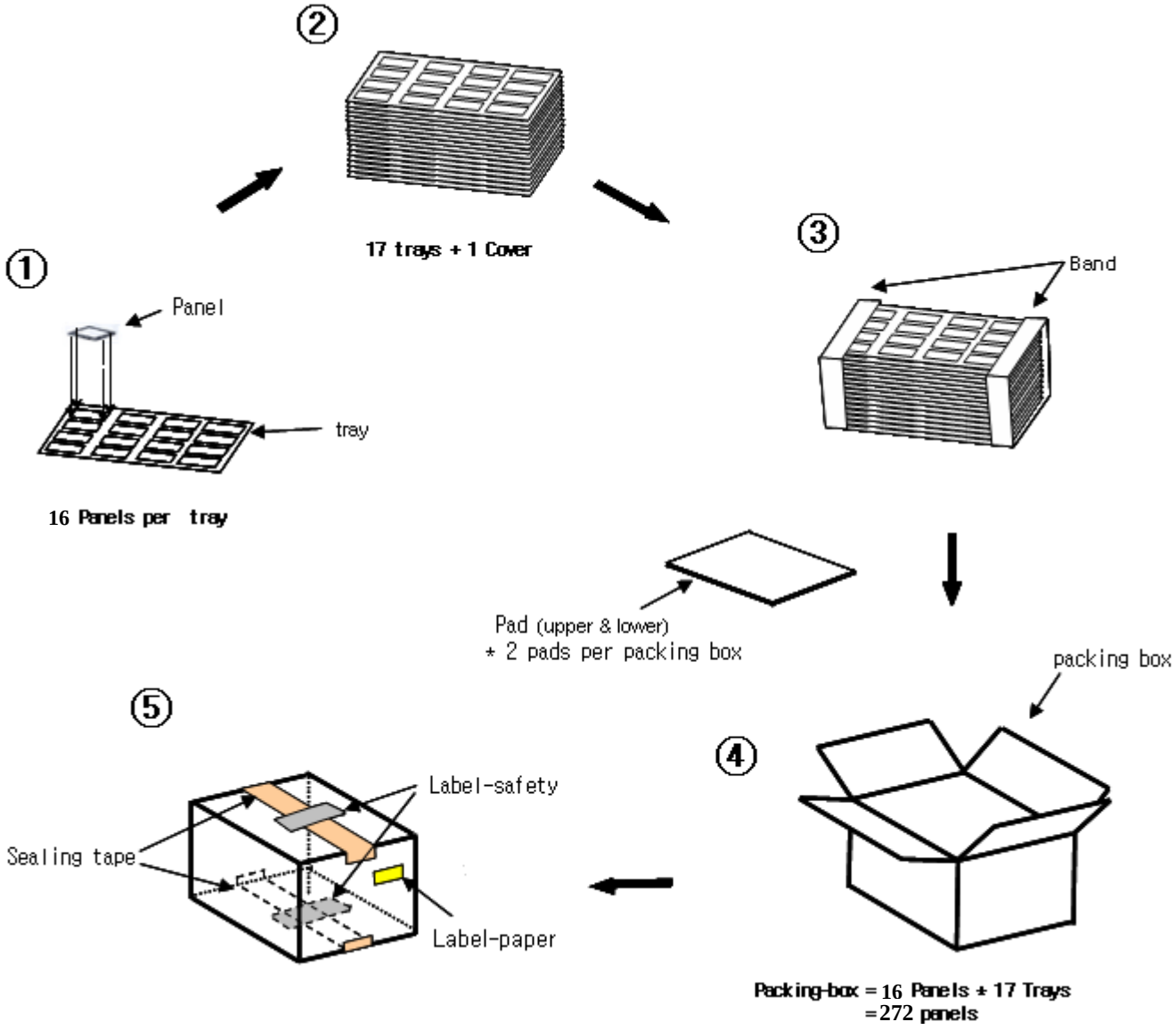
Approval

71 Pin Connector(0.3pitch Bottom Contact)



Doc. No	LMS350GF21	Rev.No	000	Page	35/39

12. Packing



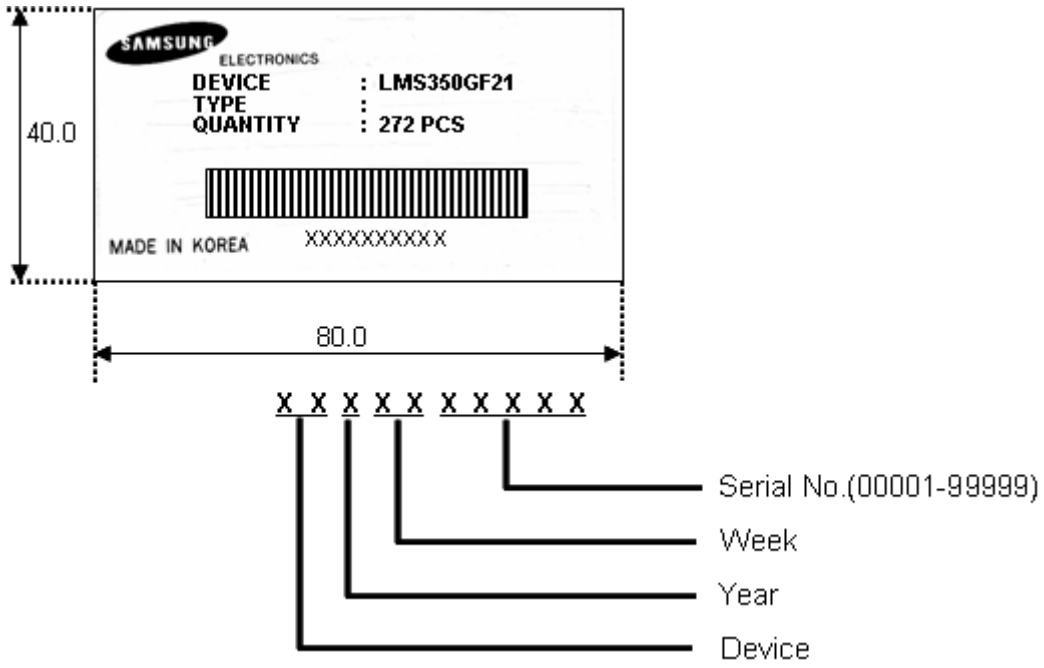
Note

(1) Total : Packing box Approx. : 14 kg
(2) Size : 505(W) x 355(D) x 200(H)
(3) Place the panels in the tray facing the direction shown in the figure.
(4) Seal the packing-box. Affix the label-safety.

13. Marking & Others

A nameplate bearing followed by is affixed to a shipped product at the Specified location on each product.

13.1 Packing case attach



14. General Precautions

14.1 Handling

(a) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Protect the module from static , it may cause damage to the Integrated Gate Circuit.

(i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(j) Do not disassemble the module.

(k) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(l) Pins of I/F connector shall not be touched directly with bare hands

14.2 Storage

(a) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C and relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

14.3 Operation

(a) Do not connect, disconnect the module in the "Power On" condition.

(b) Power supply should always be turned on/off by the "Power on/off sequence"

14.4 Others

(a) The Liquid crystal is deteriorated by ultraviolet, do not leave it in direct sunlight and strong ultraviolet ray for many hours.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value.
(the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the panel may be damaged.

(d) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.

(e) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

(f) Avoid shortness between LED soldering pad and TSP soldering pad.